Aquatic invertebrate fauna of the Two Peoples Bay area, southwestern Australia

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Abstract

The aquatic invertebrate fauna of four rivers and streams and three lakes in the Two Peoples Bay area, southwestern Australia, was sampled in June 1990 and February 1991. A total of 247 taxa were recorded: 110 in flowing waters, 170 in standing waters and 33 common to both habitats. Increased sampling intensity in February 1991 revealed a diverse microinvertebrate fauna of 47 taxa of Protozoa and Rotifera.

The macroinvertebrate fauna was similar to that reported previously from aquatic ecosystems in southwestern Australia. Thirty-six species of microinvertebrates (2 Protozoa, 21 Rotifera, 10 Cladocera and 3 Copepoda) were new records for southwestern Australia and, in many cases, Australia. The number of new records reflects greater sampling and taxonomic effort than has been used previously in southwestern Australia, but also suggests southwestern Australia may have a distinctive microfauna.

Introduction

Two Peoples Bay is an important area for wildlife conservation. It is best known as the last refuge for the Noisy Scrub-bird *Atrichornis clamosus* and a nature reserve was proclaimed in 1966 to protect this species. Because of the significance of the reserve there have been numerous surveys of its terrestrial flora and fauna, as well as detailed studies of the Noisy Scrub-bird (Smith 1985, Smith & Calver 1984).

Wetlands form a significant component of the reserve, comprising between 8.5% and 15.8% of the 4745 ha depending on time of year. The reserve and adjacent area contain three major lakes, two small rivers and numerous creeks. Water depth, salinity and pH of the lakes have been monitored for a number of years (Lane & Munro 1983) and their waterbird populations have been surveyed (Jaensch *et al.* 1988, Halse *et al.* 1992).

This paper reports results of surveys of the aquatic invertebrate fauna of the Two Peoples Bay area in June 1990 and February 1991. Results are compared with data from aquatic invertebrate work elsewhere in southwestern Australia. For streams these data come principally from the northern jarrah forest and Swan Coastal Plain (Bunn *et al.* 1986, Storey & Edward 1989, Storey *et al.* 1990), the karri forest (Growns & Davis 1991, Growns 1992) and the southern acid peat flats (Pusey & Edward 1990).

Studies of fresh lentic waterbodies have been restricted to permanent and seasonal wetlands on the Swan Coastal Plain (Balla 1993, Davis *et al.* 1993, Growns *et al.* 1992) and the southern acid peat flats (Pusey & Edward 1990), temporary pools on granite outcrops south of 32° latitude (Bayly 1982), and wetlands of the Lake Muir system (DeHaan 1987).

Study area

Two Peoples Bay (34°57'S 118°10'E) is located on the south coast of Western Australia, approximately 25 km east of Albany. The area contains three distinct drainage systems: the Goodga, the Angove, and the upland streams of the Mt Gardner headland (Fig 1).

The Goodga system comprises the Goodga River, Moates Lake and Gardner Lake and enters the sea in Two Peoples Bay. The slow-flowing Goodga River arises approximately 20 km inland. In its upper reaches, the river flows through cleared farmland before entering the reserve and discharging into Moates Lake (Fig 1).

Moates Lake has an area of 144 ha, 82 ha of which consists of fringing sedges. It is one of the deepest natural lakes in southwestern Australia, with a maximum depth of *c.* 5 m. Much of the southern shore has been inundated by a large calcareous sand dune. The Goodga River flows from Moates Lake into Gardner Lake, which covers 164 ha and has 25 ha of fringing sedges and occasionally inundated woodland. There is occasional inflow from the sea into Gardner Lake during spring tides and storm surges.

The Angove system consists of the Angove River and Angove Lake and joins the Goodga system on the seaward side of Gardner Lake. The Angove River is short (14 km) and moderately fast-flowing. The upper reaches of the river flow through uncleared Water Reserve but there is some cleared farmland around the lower reaches (Fig 1). The river is regulated by a pipehead dam built in 1912-13 to supply water to the town of Albany. Situated downstream of the dam, Angove Lake has an area of 50 ha. It contains very extensive beds of sedges and little open water; associated swamps and inundated land around the lake increase the overall wetland area to 120 ha.

The streams of the Mt Gardner headland system flow through dense shrub/heath in steep incised gullies. Websters Gully and West Gully are permanent and flow into the sea, some of the streams flow inland to disappear at the base of the headland.

Methods

Study sites were selected on the three lakes, on the main channels of the two rivers and on the lower reaches of West and Websters Gullies, which were chosen as being representative of permanent streams on Mt Gardner headland (Fig 1).

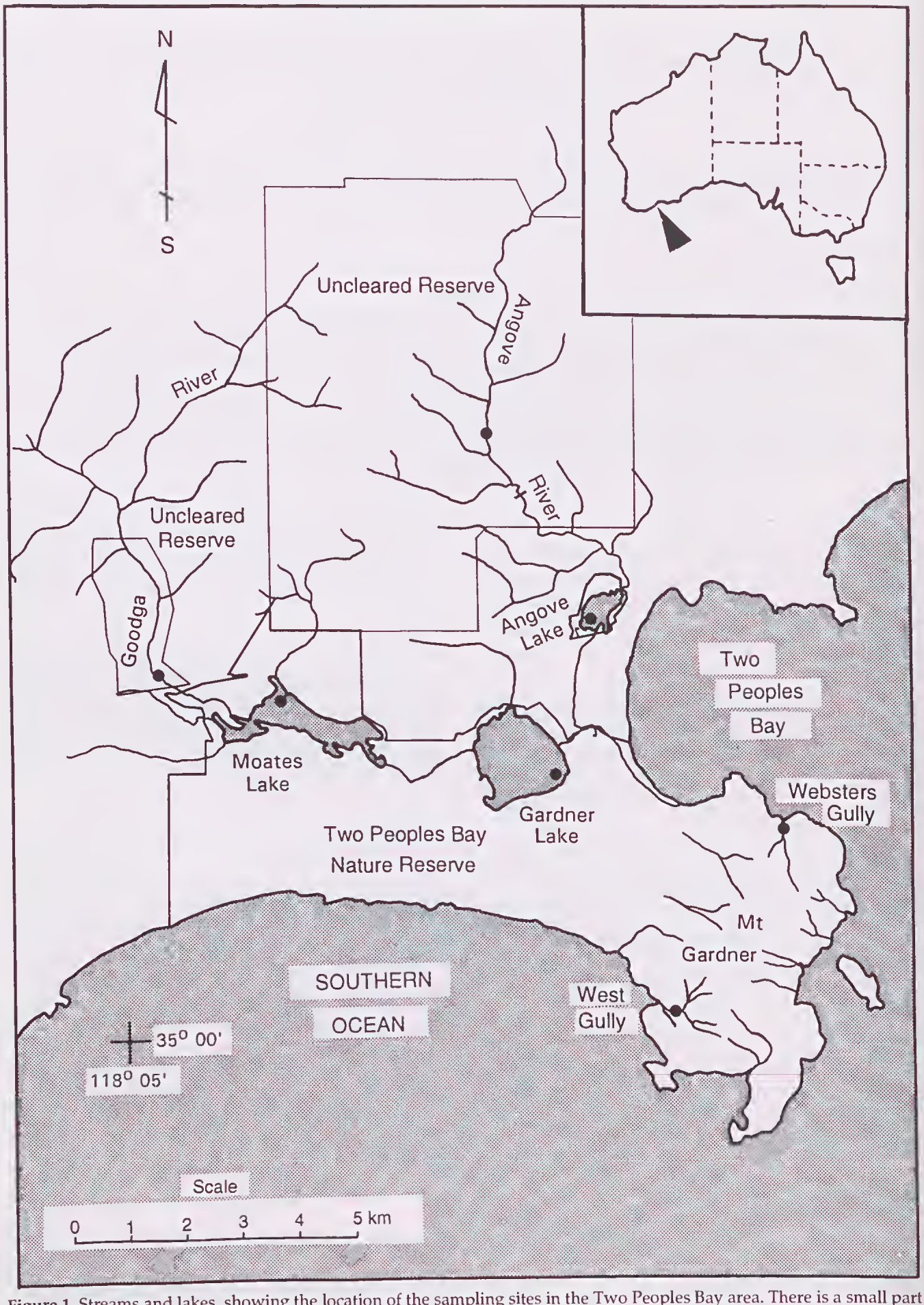

Figure 1. Streams and lakes, showing the location of the sampling sites in the Two Peoples Bay area. There is a small part of Two Peoples Bay Nature Reserve around Angove Lake

Qualitative samples of the aquatic invertebrate fauna at each site were collected in June 1990 and February 1991. Additional samples of Cladocera were taken in September 1990. All major habitats (*i.e.* water column, submerged and emergent macrophytes, leaf litter, submerged wood, organic deposits, sand/gravel beds, cobbles and bedrock) were sampled by hand and with standard FBA pondnets in June and February to maximise the number of taxa collected. Rivers and streams were sampled using a mesh size of 250 µm. Lakes were sampled initially with a mesh size of 110 µm but this was reduced to 50 µm in September and February to retain more microinvertebrates.

In the laboratory, samples were elutriated in water to separate organic and inorganic fractions. Invertebrates were removed from organic fractions by eye and under a binocular dissecting microscope. Specimens were usually identified to genus or species. When this was not possible, specimens were matched with previously curated voucher specimens. Apparently new microinvertebrate taxa were stored in 10% glycerol/water on microslides for later taxonomic treatment.

In association with the invertebrate sampling, water depth, salinity (total dissolved solids; TDS), pH, temperature and dissolved oxygen (expressed as percentage saturation) were measured at each site on each occasion.

Community composition in lotic and lentic sites at Two Peoples Bay was compared, on the basis of major taxonomic groups, with previous studies in similar habitats in southwestern Australia.

Results

Salinity was <1 g L^{-1} TDS in all waterbodies except Gardner Lake in both winter and summer (Table 1). There was little seasonal variation in salinity of Angove River, Goodga River or Moates Lake but it increased three-fold in Gardner Lake in summer to 2.55 g L^{-1} TDS.

Most of the water-bodies were neutral with respect to pH but Angove River was slightly acidic and Gardner Lake was alkaline in summer (Table 1). Angove River, West Gully and Websters Gully had the lowest water temperatures in summer, which reflected a greater amount of shading. Where sampled, the Goodga River was an open channel with little riparian vegetation. Dissolved oxygen levels were high in winter at all sampling sites except Angove River and in flooded woodland at Gardner Lake. In summer, dissolved oxygen levels were very low in West Gully and Websters Gully and moderately low in Angove River (Table 1). West Gully had stopped flowing when sampled in summer and consisted of a series of shallow pools; flow rate was very low in Websters Gully. Angove River continued to flow moderately strongly in summer but the flow rate was low in Goodga River, which had become virtually a series of long pools.

A total of 247 taxa of invertebrates were collected from the seven sites (see Appendix). Excluding protozoans and rotifers (because sampling effort was unequal between seasons), 127 taxa were collected in winter, 152 in summer and 79 taxa were common to both seasons. Thirty-nine per cent and 45 per cent of taxa were restricted to flowing and standing waters, respectively. Seventy-five per cent of the 33 taxa common to both flowing and standing waters were present in both seasons. Of the taxa restricted to one type of water-body, 32 per cent were present in both seasons.

Rivers and streams contained 110 taxa (see Appendix). Sixty-three taxa were collected in winter and 96 in summer, with 45 per cent of the fauna being common to both seasons. Eighty-three taxa were collected from the two 'lowland' rivers and 56 from the headland streams, with 11 per cent of the fauna being common to the four sites. Angove River contained 53 taxa, with 55, 40 and 43 taxa taken from Goodga River, West Gully and Websters Gully, respectively.

The three lakes contained 170 taxa (see Appendix). Excluding protozoans and rotifers, 95 taxa were taken in winter, 93 in summer and 30 per cent of the fauna was common to both seasons. Including protozoans and rotifers, 96 taxa occurred in Angove Lake, 72 in Gardner Lake, 85 in Moates Lake. Seventeen per cent of the fauna was common to the three lakes.

The rivers and streams were dominated by insects whereas the lakes were dominated by crustaceans and rotifers (see Appendix).

Discussion

Community composition

Few species (17%) occurred in all three lakes at Two Peoples Bay. The same phenomenon was noted in closely adjacent billabongs on the River Murray floodplain by Hillman & Shiel (1991). They proposed that species were responding to inter-habitat differences and that different species occurred under slightly different conditions.

Table 1

Some physical and chemical parameters of the streams and lakes at Two Peoples Bay that were sampled for invertebrates in June 1990 (Winter) and February 1991 (Summer).

Parameter	Season	Angove River	Goodga River	West Gully	Websters Gully	Angove Lake	Gardner Lake	Moates Lake
Depth (m)	W	0.50	0.40	0.40	0.30	1.75	2.60	4.39
	S	0.40	0.30	0.20	0.60	1.59	1.82	3.96
Salinity (g L^{-1})	W	0.25	0.56	0.44	0.18	0.58	0.88	0.47
	S	0.26	0.52	0.55	0.32	0.64	2.55	0.42
pH	W	5.88	6.31	6.54	6.75	6.78	7.60	6.68
	S	5.65	6.29	6.00	6.66	7.13	8.98	7.27
Temp (°C)	W	13.1	11.4	10.8	11.4	13.3	10.7	11.5
	S	16.6	23.7	16.8	16.2	26.0	22.6	25.5
D.O. (%)	W	72.0	87.0	93.0	93.0	96.0	99.5*	95.5
	S	67.0	91.0	29.0	49.0	114	117	116

*23% in flooded melaleuca woodland

Overall, the rivers and streams at Two Peoples Bay were similar in community composition to other streams studied in southwestern Australia (Table 2). The number of taxa varied considerably between studies but that may have been a result of different numbers of sampling sites and sampling frequency.

In contrast, community composition appeared to vary among the lake studies (Table 2), with Two Peoples Bay being dominated by microinvertebrates while the peat lakes, especially, contained relatively more insects. Without additional sampling, it is unclear how many of the differences between lakes were a result of different sampling methods, sampling intensity and varying taxonomic effort. It should be noted, however, that rotifers were examined only in the Two Peoples Bay study and, owing to the nature of the project, little effort was spent identifying microcrustaceans or chironomids at Lake Muir (DeHaan 1987).

Seasonality

Seasonality was evident in the occurrence of some taxa from both flowing and standing waterbodies at Two Peoples Bay. For example, the chironomids *Cladopelma curtivalva, Procladius paludicola, ?Harnischia* sp. VTPB4, *Cladotanytarsus ?mancus, Chironomus* aff. *alternans*, the empididan larvae, the trichopteran *Hellyethira malleoforma* and the copepod *Eucyclops australiensis* were recorded only in summer (see Appendix).

The chironomids Orthocladiinae sp. VTPB1, Tanytarsini sp.A, Orthocladiinae sp. A, the coleopteran *Lancetes lanceolatus*, the cladoceran cf. *Pleuroxus* sp. A, the copepods *Microcyclops* sp. A and *Onychocamptus chathamensis* were collected only in winter.

Seasonality of aquatic invertebrates in streams of the northern jarrah forest has been reported previously (Bunn *et al.* 1986, Storey *et al.* 1990). Bunn *et al.* (1986) proposed that the predictable climate of southwestern Australia resulted in the aquatic fauna of forested streams developing synchronized life-cycles (Bunn 1988) that give rise to distinct differences between the faunas of winter and summer. Seasonality has also been observed in the aquatic fauna of streams in the karri forest (Growns & Davis 1991, Growns 1992). It is likely that this pattern applies to most waterbodies of southwestern Australia but, with the exception of Balla (1993), there are no data on life histories and seasonality of invertebrates in standing waters.

Table 2

Number of taxa identified in major taxonomic groupings in studies of the invertebrate fauna of some rivers, streams and lakes in south-western Australia

	Streams				Lakes			
	Two Peoples Bay[1]	Jarrah forest[2]	Karri forest[3]	Acid peat flats[4]	Two Peoples Bay[1]	Swan Coastal Plain[5]	Peat lakes[6]	Acid peat flats[4]
Protozoa	—	—	—	—	6	—	—	—
Rotifera	—	—	—	—	41	—	—	—
Nematoda	1	1	1	—	1	1	—	—
Mollusca	1	8	3	1	2	13	5	2
Annelida	1	1	1	1	1	5	3	1
Arthropoda								
Arachnida	8	1	10	4	6	20	11	9
Crustacea								
Cladocera	1	5	—	4	26	37	1	5[7]
Ostracoda	3	5	3	4	9	26	5	8[7]
Copepoda	4	9	—	4	17	10	1	4[7]
Decapoda	4	3	1	1	4	2	3	1
Amphipoda	5	4	4	3	2	3	2	3
Isopoda	3	2	1	2	2	1	1	1
Others	—	—	—	—	—	1	—	—
Insecta								
Diptera								
Chironomidae	28	86	36	27	24	23	9	30
Others	15	44	56	13	10	20	5	8
Odonata	8	17	7	—	3	13	5	1
Hemiptera	—	10	2	—	3	18	12	2
Ephemeroptera	4	7	9	2	1	2	1	2
Plecoptera	2	3	2	1	—	—	—	2
Trichoptera	13	36	20	9	5	5	10	13
Coleoptera	7	33	11	4	7	42	23	11
Others	2	1	2	—	—	1	2	—
Others	—	11	2	—	—	2	—	—
TOTAL	110	287	171	80	170	245	99	103
NO. OF SITES	4	>30	22	2	3	40	4	6[7]
NO. OF SAMPLING OCCASIONS	2	12	12[8]	5	2	3	2	5[7]

[1]This study

[2]Bunn *et al.* (1986), Storey & Edward (1989), Storey *et al.* (1990)

[3]Growns & Davis (1991), Growns (1992)

[4]Pusey & Edward (1990)—Collembola omitted

[5]Davis *et al.* (1993), Growns *et al.* (1992)

[6]De Haan (1987)—Collembola omitted

[7]Extra sampling by I A E Bayly

[8]Ten sites were sampled only four times

Some life history strategies result in taxa being present in waterbodies all year. For example, the amphipod *Uroctena setosa*, the trichopteran *Smicrophylax australis* and the anisopteran *Austroaeschna anacantha* are known to require more than one year to reach maturity (Bunn 1988) and, therefore, it is not surprising that they occurred in both summer and winter at Two Peoples Bay. The ephemeropteran *Nyungara bunni* and the trichopteran *Taschorema pallescens* also occurred in both seasons; Bunn (1988) described these species as multivoltine, with overlapping generations breeding all year.

Terrestrial species

Six taxa collected in this study (the ostracod *?Mesocypris* sp. 291, the amphipods *Agilestia* sp. A and *Austrotroides pectinalis* and the three isopods) are usually regarded as terrestrial but we are confident that, with the possible exception of *?Mesocypris* sp. 291, all were submerged in lakes, rivers or streams when collected.

In addition to West Gully and Gardner Lake, the isopod *Styloniscus australiensis australiensis* has been recorded from submerged root mats in a subterranean stream in Western Australia (B Knott, unpubl. data). The species appears to have a facultative aquatic life-history. Another isopod with the branchial morphology of a terrestrial species, *Haloniscus stepheni*, was recently found submerged in salt lakes (A J A Green, S Halse and B Knott, unpubl. data). Re-examination of the amount of time 'terrestrial' isopods spend in aquatic situations seems warranted.

Richness and endemism

The macroinvertebrate fauna of streams and rivers in southwestern Australia is depauperate in comparison to southeastern Australia (Bunn & Davies 1990). The same applies to the native fish fauna (Allen 1982, Merrick & Schmida 1984). However, this study suggested that the wetland microfauna is richer than previously recognized: there were many new records for Western Australia and, in some cases, Australia. Many of the taxa were undescribed.

Protozoan communities of inland waters of Western Australia are virtually unstudied. Foissner & O'Donoghue (1990) described five new species from a freshwater pond in Perth and Post *et al.* (1983) described 14 new species from a saline lagoon north of Perth. Taxa identified at Two Peoples Bay were all testate amoebae, the cases of which were noted whilst searching for larger microfauna. Most could be identified only to genus. It seems likely that Australia has a distinctive protozoan fauna but lack of data prevents speculation about the fauna of different regions.

Little is known of the rotifer communities of Western Australia. Koste *et al.* (1983) reviewed available records and listed 83 taxa from the southwest. Given that 21 of the 41 rotifers collected at Two Peoples Bay were not listed by Koste *et al.* (1983), it would seem that many more species remain to be found. Areas in eastern Australia of comparable size to the southwest of Western Australia have 300-500 rotifer species (R J Shiel, unpubl. data).

Many rotifers appear to be cosmopolitan or very widely-dispersed (Dumont 1983). Collections from Two Peoples Bay contained the first records of *Lecane imbricata* and *Monostyla rhophalura* for Australia (see Appendix) and at least two undescribed species (*Monostyla* sp. nov. A and *Notommata* sp. nov. A). Furthermore, several taxa (identified to genus in Appendix) resembled rotifers known from eastern Australia but had slightly different morphology. Although studies on populations from both sides of the continent are required to determine whether this represented ecotypic variation or reflected east-west divergence, the existence of at least two, and possibly several, undescribed species in the small sample from Two Peoples Bay supports Koste *et al.*'s (1983) belief that there is a comparatively high level of endemism in the southwestern Australian rotifer fauna.

The distinctiveness and richness of the Western Australian cladoceran fauna was pointed out by Frey (1991). In revising the taxonomy of Australian species formerly assigned to the genus *Pleuroxus*, he described two new genera and four new species from southwestern Australia and suggested that there has been significant adaptive radiation compared with eastern Australia. Of the 27 cladoceran taxa collected from Two Peoples Bay, at least five species appear to be undescribed (*Biapertura* sp. M1., cf. *Pleuroxus* sp. A, Chydoridae sp. A1, Chydoridae sp. M2 and Macrothricidae gen. nov.).

The high level of endemicity among calanoid copepods in Western Australia was noted by Maly & Bayly (1991). The harpacticoid copepods we collected support Hamond's (1987) suggestion that an interesting fauna awaits discovery in southwestern Australia. Canthocamptidae sp. A is possibly undescribed and the record of *Schizopera clandestina* from Gardner Lake is the first in the southern hemisphere of a species previously known only from western Europe. The occurrence of a species of *Leptomesochra* in Websters Gully is unusual: there are very few records of the genus from other than the benthos of the open sea or, less commonly, coarse sand on a marine shore (R Hammond, pers. comm.).

Most cyclopoid copepods could be identified only to genus because the taxonomy of the group is poorly known. Undescribed species occur in Western Australia (D W Morton, pers. comm.) but the level of endemicity is unknown.

There are many undescribed species of ostracod in fresh and saline waters of southwestern Australia (P DeDeckker & S A Halse, unpubl. data). Of taxa collected at Two Peoples Bay, the genus *Paralimnocythere* is known to be represented in Australia only by the Two Peoples Bay specimens and an undescribed species from Ellen Brook on the Swan Coastal Plain. *Gomphodella* aff. *maia* collected from Two Peoples Bay is widespread in southwestern Australia but is distinct from the eastern Australian species *G. maia* (DeDeckker 1981, and pers. comm.).

Salinity and disturbance

With the exception of Gardner Lake, which becomes brackish in summer, all waterbodies sampled at Two Peoples Bay were fresh (Table 1). Furthermore, vegetation was intact around the lakes and there had been minimal impact of human activity on the aquatic systems. This is unusual in southwestern Australia, where salination as a result of land-clearing is widespread (Schofield *et al.* 1988). Many fresh waterbodies on the Swan Coastal Plain have been modified or become eutrophic (Halse 1989) and the extreme southwest of Western Australia, from Two Peoples Bay to Augusta, is the only region containing extensive areas of undisturbed wetlands.

Many species of aquatic invertebrate cannot tolerate low levels of salinity (Hart *et al.* 1991) or the extent of disturbance common on the Swan Coastal Plain (Growns *et al.* 1992; Davis *et al.* 1993). Some species in the wetlands of Two Peoples Bay have probably persisted only because the waterbodies are relatively undisturbed. It is likely the wetlands of the extreme southwest of Western Australia will be important for the future conservation of freshwater invertebrates.

Biogeography

Little is known about the biogeography of aquatic invertebrates of Western Australia but we speculate that:

(1) Rotifers and microcrustaceans, which have drought-resistant stages and poor powers of active dispersal (Dumont 1983), probably have experienced considerable radiation and, therefore, show a high degree of endemism (Frey 1991). More mobile groups, such as insects and water mites, the larvae of which are parasitic on adult insects (M Harvey, pers. comm.), demonstrate less endemism.

(2) The occurrence of several species only in southwestern Australia and Tasmania suggests there may be a biogeographic link between these regions. Shiel *et al.* (1989) recorded a highly diverse rotifer fauna from acidic lakes in western Tasmania, with a predominance of taxa now recorded primarily in the tropics. They proposed that this fauna "may have persisted in Tasmanian waters as relict populations from a time when Tasmania's climate, and that of southern Australia was tropical". Contraction in the distribution of many species is thought to have occurred when Australia experienced an arid phase approximately 18 000 year BP, during which many lakes dried and populations survived in permanent, coastal lakes (De Deckker 1986). Shiel *et al.* (1989) suggest that due to the prevailing westerly wind, lakes in coastal western Tasmania acted as refugia by remaining permanent during this arid period, and ice-free during the height of the last glaciation.

During the arid period, refugia probably also existed in coastal southwestern Australia owing to the ameliorating effects on climate of the prevailing south-westerly winds. Temperatures and the availability of water appear to have remained fairly constant over the last 30 000 years (Thorpe & Davidson 1991). It is likely that lakes on the western coast of Tasmania and southwestern coast of Western Australia today contain relicts from the eastern and western extremes of the range of a once widespread fauna.

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Appendix. Invertebrate species collected in streams and lakes of the Two Peoples Bay area in June 1990 and February 1991.

S = summer, W = winter, B = both seasons, * = sampled only in summer. Winter samples of taxa marked with * collected in September 1991. First records for Western Australia marked with +. Voucher specimen numbers are used for some undescribed species (*e.g.* Biapertura sp. M1, Ilyodromus sp. 255, Macropelopia sp. V9)

AG, Angove River; GR, Goodga River; WG, West Gully; WbG, Websters Gully; AL, Angove Lake; GL, Gardner Lake; ML, Moates Lake.

	AR	GR	WG	WbG	AL	GL	ML
PROTOZOA							
Arcella sp. A							*
Centropyxis sp. A							*
+*Difflugia acuminata* Ehrenberg					*		
Difflugia sp. A							*
Eulypha sp. A					*		
+*Lesquereusia spiralis* (Ehrenberg)					*		*
ROTIFERA							
Bdelloida sp. A							*
Brachionus cf. *angularis bidens* Plate						*	*
Brachionus quadridentatus Hermann						*	
+*Dipleuchlanis propatula* (Gosse)					*		*
Euchlanis dilatata Ehrenberg					*		
+*Filinia* cf. *australiensis* Koste							*
+*Filinia* cf. *pejleri* Hutchinson						*	
+*Filinia* sp. A					*		
+*Heterolepadella ehrenbergi* (Perty)					*		
Keratella javana Hauer					*		
Keratella procurva (Thorpe)					*		
Keratella sp. A							*
+*Lecane imbricata* Carlin					*		*
+*Lecane* cf. *ohioensis* (Herrick)							*
+*Lecane signifera* (Jennings)					*		
+*Lepadella rottenburgi* (Lucks)					*		
+*Lepadella triptera* (Ehrenberg)					*		
Lepadella sp. A					*		
+*Macrochaetus collinsi* (Gosse)					*		
Monommata sp. A					*		
Monostyla bulla (Gosse)					*	*	*
Monostyla lunata (Stokes)					*		*
Monostyla lunaris Ehrenberg					*		
+*Monostyla crenata* (Harring)					*	*	
+*Monostyla furcata* Murray					*	*	
+*Monostyla quadridentata* (Ehrenberg)					*		
+*Monostyla rhophalura* Harring & Myers					*		
+*Monostyla* sp. nov. A					*		
+*Notommata* sp. nov. A						*	
Platyias quadricornis (Ehrenberg)					*		
+*Testudinella amphora* Hauer					*		
Testudinella insinuata Hauer					*		
Testudinella nr *patina* (Hermann)							*
+*Testudinella tasmaniensis* Koste & Shiel							*
Trichocerca elongata (Gosse)							*
Trichocerca pusilla Jennings						*	
+*Trichocerca rattus carinata* (Ehrenberg)					*		
+*Trichocerca rattus cristata* (Harring)							*
Trichocerca sp. A1					*		*
Trichocerca sp. A2					*		
Trichotria tetractis (Ehrenberg)					*		*
NEMATODA			S	S	B	B	B
MOLLUSCA							
GASTROPODA							
PULMONATA							
Ancylidae							
Ferrissia petterdi (Johnston)	W	B		B			W
Planorbidae							
Physastra sp. A						B	
ANNELIDA							
OLIGOCHAETA	B	B	B	W	B	B	B
ARTHROPODA							
ARACHNIDA							
ORIBATIDA					W	B	B
HYDRACARINA							
Arrenuridae							
Arrenurus sp. A			S				
Arrenurus sp. B				S			
Oxidae							
Flabellifrontipoda sp. A	W						
Limnochares australica Lundblad					S		
Oxus sp. A					W	B	B
Frontipoda sp. A	S						
Unionicolidae							
Koenikea sp. A						B	
Newmania sp. A		S					
Hygrobatidae							
Corticarus sp. A		W					
Gretacarus sp. A						S	S
Coaustraliobates sp. A	S						
Halacaridae							
Halacaridae sp. A							W
Soldanellonyx sp. A				S			
CRUSTACEA							
CLADOCERA							
Sididae							
Latonopsis cf. *brehmi* Petkovski						S	
Chydoridae							
Alonella cf. *clathratula* Sars							S
Biapertura cf. *affinis* (Leydig)							W
Biapertura cf. *rigidicaudis* Smirnov						W	
+*Biapertura* cf. *setigera* (Brehm)						S	S
+*Biapertura* sp. M1							B
Camptocercus cf. *australis* Sars							S
**Chydorus* sp. A						B	W S
Dunhevedia crassa King							W
Ephemeroporus barroisi Frey s. l.							S
+*Euryalona* cf. *orientalis* (Daday)						W	
Graptoleberis cf. *testudinaria* (Fischer)							W
+*Monope reticulata* (Henry)							S
+cf. *Pleuroxus* sp. A						W	W
+*Rhynchochydorus* nr *australiensis* Smirnov & Timms						S	
+Chydoridae sp. A1						B	
+Chydoridae sp. M2							S
Macrothricidae							
Echinisca sp. A						W	
Ilyocryptus sp. A						W	
Macrothrix cf. *breviseta* Smirnov & Timms						B	
Neothrix armata Gurney						B	
+Macrothricidae gen. nov. A						S	
Daphniidae							
Scapholeberis nr *kingi* Sars						S	S
Simocephalus exspinosus australiensis (Dana)	S						
Simocephalus sp. A							W
Bosminidae							
Bosmina meridionalis Sars							W B
Bosmina sp. A							W
OSTRACODA							
Ostracoda sp. 287							S
Cyprididae							
Cypretta baylyi McKenzie				B		W	
+*Ilyodromus* sp. 255			B	S			
Kennethia cristata De Deckker						B	W W
Alboa worooa DeDeckker						S	W
?*Mesocypris* sp. 291				S			
Darwinulidae							
?*Darwinula* sp. A						W	S
Limnocytheridae							
Gomphodella aff. *maia* DeDeckker						B	B
Limnocythere mowbrayensis Chapman							W
+*Paralimnocythere* sp. nov.							B S
Candonidae							
Candonopsis tenuis (Brady)						W	W S
COPEPODA							
Centropagidae							
Calamoecia attenuata (Fairbridge)						B	B
Calamoecia tasmanica Smith s. l.							S
Calamoecia tasmanica subattenuata (Fairbridge)						B	W B
Gladioferens imparipes Thomson						S	B
Cyclopidae							
Eucyclops australiensis Morton		S				S	S S
Halicyclops sp. A							S
Microcyclops sp. A						W	W W
Thermocyclops sp. A						B	W W
Macrocyclops albidus (Jurine)		S				W	W B
Paracyclops chiltoni (Thomson)		S		S			
Paracyclops sp. A							W S
Canthocamptidae							
+Canthocamptidae sp. A						W	W
Canthocamptidae sp. 15						S	S
Canthocamptidae sp. 16							S
Leptomesochra sp. A				S			
Onychocamptus bengalensis (Sewell)							S
+*Onychocamptus chathamensis*						W	W
Nitocra sp. A							S B
+*Schizopera clandestina* (Klie)							W
DECAPODA							
Parastacidae							
Cherax plebejus (Hess)	B	W					W
Cherax quinquecarinatus (Gray)	B	S				W	S
Cherax tenuimanus (Smith)	W	B				W	S
Palaemonidae							
Palaemonetes australis Dakin		B				B	B B

	AR	GR	WG	WbG	AL	GL	ML
AMPHIPODA							
Ceinidae							
Austrochiltonia subtenuis Hurley					W	B	B
Gammaridae							
Perthia branchialis (Nicholls)	B	S			B		S
Perthia acutitelson Straskraba		W					
Uroctena setosa Nicholls			B				
Talitroidea							
Agilestia sp. A			S	S			
Austrotroides pectinalis Friend		S					
ISOPODA							
Philosciidae							
?Laevophiloscia sp. A			S				
?Plymophiloscia sp. A			S			W	
Styloniscidae							
Styloniscus australiensis australiensis Vandel			S			W	
INSECTA							
MEGALOPTERA							
Chauliodidae							
Archichauliodes cervulus Theischinger	B						
LEPIDOPTERA							
Lepidoptera sp. B		S					
DIPTERA							
Simuliidae							
Cnephia tonnoiri tonnoiri Drummond	B	W	W	W			
Austrosimulium furiosum (Skuse)	B	W					
Culicidae							
Aedes sp. A						W	
Anopheles annulipes Walker			S				
Culex australicus Dobrotworsky & Drummond			S	S			
Culex globocoxitus Dobrotworsky						W	
Chironomidae							
Tanypodinae							
Coelopynia pruinosa Freeman							S
Paramerina levidensis (Skuse)	S	S	B	B	S	W	B
Macropelopia dalyupensis (Freeman)					W		S
Macropelopia sp. V9	W						
?Ablabesmyia sp. V10	B						
Tanypodinae sp. V20			S				
Orthocladiinae							
Corynoneura ?scutellata Winnertz						W	
Cricotopus annuliventris (Skuse)	B	B	W	B			
Stictocladius uniserialis Freeman		W					
Nanocladius sp. VCD7							W
Thienemanniella sp. V19	B	W	W	W			
Limnophyes pullulus (Skuse)	S			B	W	W	B
?Limnophyes sp. V31	W						S
Orthocladiinae sp. V11	B	B		W			
Orthocladiinae sp. VTPB1					W	W	
Orthocladiinae sp. VTPB2					S		
Orthocladiinae sp. VTPB3	S						
Orthocladiinae sp. V59	B						
Orthocladiinae sp. A					W	W	
Chironominae							
Cladopelma curtivalva (Kieffer)		S			S		S
?Harnischia sp. VTPB4		S					S
Polypedilum sp. V3	B	S	B	W	W		B
Polypedilum sp. V33	B			B			
Polypedilum sp. A						S	
Procladius paludicola Skuse		S			S	S	S
Riethia sp. V4	B	B	S				S
Riethia sp. V5	B		B	S			S
Cladotanytarsus ? mancus (Walker)						S	S
Tanytarsus sp. V6	B	B	W	B	W		B
Tanytarsus sp. A					S		S
Tanytarsus sp. B					S		
Stempellina ?australiensis Freeman	B	S	B	S			
?Paratendipes sp. V12	W						
Rheotanytarsus sp. V18	S	W				S	
Cryptochironomus griseidorsum Kieffer		B		S			W
Stenochironomus sp. V27	B						
Chironomus aff. *alternans* Walker	S		S				
Tanytarsini sp. A						W	W
Chironomini sp. V21	S						
Dicrotendipes sp. V47		S					
Tipulidae							
Limoniinae sp. A	S		B	B		W	
Limoniinae sp. B			B	W			
?Pedicia sp. A			W	W			
Tipulinae sp. A	S		B	S			
Ceratopogonidae							
Ceratopogonidae sp. A	W		W	B			
Ceratopogonidae sp. B		B	S	B	W	B	W
Ceratopogonidae sp. C						W	
Ceratopogonidae sp. D							W
Ceratopogonidae sp. F				S			
Ceratopogonidae sp. G							S
Ceratopogonidae sp. K		S					
Ceratopogonidae sp. O				S			
Stratiomyidae							
Stratiomyidae sp. A							W
Stratiomyidae sp. B							S
Dolichopodidae							
Dolichopodidae sp. A						W	
Empididae							
Empididae sp. A	S	S					
Empididae sp. B	S		S	S			
ODONATA							
ZYGOPTERA							
Coenagrionidae							
Ischnura sp. A						W	W
Ischnura aurora (Brauer)		S					
ANISOPTERA							
Aeschnidae							
Austroaeschna anacantha Tillyard	B	B	B	B			S
Corduliidae							
Lathrocordulia metallica Tillyard	S						
Cordulüdae sp A (immature)	W						
Hemicordulia tau Selys		S					
Gomphidae							
Austrogomphus collaris Hagen		B					
Libellulidae							
Diplacodes haematodes (Burmeister)						W	
Synthemidae							
Synthemis macrostigma occidentalis Tillyard				W			
Synthemis cyanitincta Tillyard	S						
HEMIPTERA							
Veliidae							
Veliidae sp. A						W	
Corixidae							
Agraptocorixa sp. A						S	
Micronecta robusta Hale						W	
EPHEMEROPTERA							
Leptophlebiidae							
Nyungara bunni Dean	B						
Bibulmena kadjina Dean		W	B	B			
Neboissophlebia occidentalis Dean	S	S					
Caenidae							
Tasmanocoenis tillyardi (Lestage)		B				W	
PLECOPTERA							
Gripopterygidae							
Newmanoperla exigua (Kimmins)		W					
Gripopterygidae sp. A (immature)			W				
TRICHOPTERA							
Hydropsychidae							
Smicrophylax australis (Ulmer)	B	B					
Ecnomidae							
Ecnomina sciudens/trulla/merga group	B						
Ecnomus pansus/turgidus complex		B	W				S
Leptoceridae							
Condocerus aptus Neboiss	B			B			
Lectrides parilis Neboiss	B	S	B	B			
Oecetis spp.		S			S	S	S
Triplectides sp. A	W						
Triplectides australis Navas					W	W	B
Notoperata tenax Neboiss	S						
Hydroptilidae							
Hellyethira nualleoforma Wells		S			S	S	S
Oxyethira retracta Wells	W	S					
Maydenoptila ?rupina Neboiss		W					
Hydroptila losida Mosely		S					
Hydrobiosidae							
Taschorema pallescens (Banks)	B	B	B	B			
Polycentropodidae							S
Plectrocnemia ?exima Neboiss							
COLEOPTERA							
Dytiscidae							S
Antiporus femuralis (Boheman)						W	W
Lancetes lanceolatus (Clark)							W
Liodessus dispar (Sharp)						W	
Megaporus howitti (Clark)							
Megaporus solidus (Sharp)		S					
Necterosoma darwini (Babington)				B			
Necterosoma sp. B (larva)			S	S			
Rhantus suturalis (MacLeay)			S	W			W
Sternopriscus browni Sharp							
Sternopriscus sp. A						S	
Platynectes decempunctatus (Fabricius)			S				
Helodidae							
Helodidae sp. A	S	S	B	B			W
Hydrophilidae							
Hydrophilidae sp. 1			S				
Number of Species	53	55	40	43	96	72	85